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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/726,871	12/03/2003	Seung Ho Hahn	20061/OF03P160	5405

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EXAMINER	
KENNEDY, JENNIFER M	

ART UNIT	PAPER NUMBER
2812	

DATE MAILED: 10/05/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/726,871	HAHN, SEUNG HO	
	Examiner	Art Unit	
	Jennifer M. Kennedy	2812	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *06 July 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-13* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-13* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

In view of Applicant's amendment to the claims, the rejections of claims the objections to claims 2 and 5 are withdrawn.

Claim Objections

Claim 7 is objected to because of the following informalities: The examiner suggests insert –the—before "annealing" for grammatical correctness. Appropriate correction is required.

Claim 7 is objected to because of the following informalities: The examiner suggests insert –an—before "LDD structure" for grammatical correctness. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 7 and 8 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 7 recites the limitation forming source/drain regions after annealing of the substrate. It is unclear if applicant is referring to the annealing that is done to form a re-

oxidation layer or if this could be any annealing step performed on the substrate prior to the formation of the source/drain.

Claim 8 recites the limitation forming LDD structure after annealing the substrate. It is unclear if applicant is referring to the annealing that is done to form a re-oxidation layer or if this could be any annealing step performed on the substrate prior to the formation of the LDD structure.

The examiner notes as currently claimed any annealing step prior to forming the source/drain or LDD region, such as an oxidation step to form a gate oxide layer, could read on the claim. The examiner suggests insert "the" or said" before "annealing".

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 3, 4, and 6 are rejected under 35 U.S.C. 102(b) as being anticipated by Tsai et al. (U.S. Patent No. 5,648,287).

In re claim 1, Tsai et al. disclose the method of manufacturing a semiconductor device, the method comprising:

successively depositing gate insulating layer forming material (14) and gate electrode forming material (18, 32) on a semiconductor substrate;

patterning the gate insulating layer forming material and the gate electrode forming material to form a gate insulating layer and a gate electrode (see column 6, lines 24-27);

performing a nitrogen ion-implantation to a front face of the substrate and the gate electrode (see column 7, lines 19-34); and

annealing the substrate so as to form a re-oxidation layer (36, 37) that has different thickness on the sidewalls (36) of the gate electrode than on the substrate (37, see column 7, lines 35-45).

In re claim 3, Tsai et al. disclose the method wherein the dose of nitrogen ion implantation is 10^{14} to $5x10^{15}$ atoms/cm^2 (see column 7, lines 27-30).

In re claim 4, Tsai et al. disclose the method wherein an angle of nitrogen ion implantation is vertical to the substrate (see column 7, lines 19-25).

In re claim 5, Tsai et al. disclose the method wherein the dose of nitrogen ion implantation is 10^{14} to $5x10^{15}$ atoms/cm^2 (see column 7, lines 27-30).

Claims 1, 3, 7-8, and 10 are rejected under 35 U.S.C. 102(b) as being anticipated by Chiao (U.S. Patent No. 4,503,601).

In re claim 1 Chiao discloses the method of manufacturing a semiconductor device, the method comprising:

successively depositing gate insulating layer forming material (13) and gate electrode forming material (14) on a semiconductor substrate;

patterning the gate insulating layer forming material and the gate electrode forming material to form a gate insulating layer and a gate electrode (see Figure 2, and column 5, lines 2-10);

performing a nitrogen ion-implantation to a front face of the substrate and the gate electrode (see column 4, lines 60-68); and

annealing the substrate so as to form a re-oxidation layer that has different thickness on the sidewalls of the gate electrode than on the substrate (see column 5, line 53 through column 6, line 4).

In re claim 3, Chiao discloses the method wherein the dose of nitrogen ion implantation is 10^{14} to $5x10^{15}$ atoms/cm^2 (see column 4, lines 60-68).

In re claim 7, Chiao disclose the method wherein forming source/drain regions after annealing of the substrate (see column 5, line 53 through column 6, line 5 and lines 52-65 for the source/drain regions, and column 7, lines 35-65 for the LDD structure).

In re claim 8 Chiao discloses the method of manufacturing a semiconductor device, the method comprising:

successively depositing gate insulating layer forming material (13) and gate electrode forming material (14) on a semiconductor substrate;

patterning the gate insulating layer forming material and the gate electrode forming material to form a gate insulating layer and a gate electrode (see Figure 2, and column 5, lines 2-10);

performing a nitrogen ion-implantation to a front face of the substrate and the gate electrode (see column 4, lines 60-68); and

annealing the substrate so as to form a re-oxidation layer that has different thickness on the sidewalls of the gate electrode than on the substrate (see column 5, line 53 through column 6, line 4)

forming LDD structure after annealing the substrate (see column 7, lines 35-65).

In re claim 10, Chiao discloses the method wherein the dose of nitrogen ion implantation is 10^{14} to $5x10^{15}$ atoms/cm^2 (see column 4, lines 60-68).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 2 and 5 rejected under 35 U.S.C. 103(a) as being unpatentable over Tsai et al. (U.S. Patent No. 5,648,287) in view of Yoo et al. (U.S. Patent No. 6,486,039).

Tsai et al. disclose the method as claimed and rejected above, including wherein the energy of the nitrogen ion implantation is at an energy between about 30 and 70, however, Tsai et al. does not disclose the units of the energy applied. Therefore, Tsai et al. does not disclose the method wherein energy of ion implantation is 10 to 50 keV. Yoo et al. disclose the method of implanting nitrogen at an energy of between 10 and 30

keV. It would have been obvious to one of ordinary skill in the art at the time the invention was made to perform the nitrogen ion implantation of Tsai et al. at the energy at which Yoo et al. discloses since the energy range at which Yoo et al. implants is sufficient to change the oxidation rate of the underlying material (see Yoo et al., column 5, lines 4-37).

Claim 7-8, 10-11 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsai et al. (U.S. Patent No. 5,648,287) in view of Chiao (U.S. Patent No. 4,503,601).

Tsai et al. disclose the method as claimed and rejected above, but does not disclose the method of forming the source/drain regions or the LDD structure after annealing of the substrate. Chiao discloses the method of forming the source/drain regions or the LDD structure after annealing of the substrate (see column 5, line 53 through column 6, line 5 and lines 52-65 for the source/drain regions, and column 7, lines 35-65 for the LDD structure).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the source/drain regions or LDD structure after annealing the substrate because it allows for fabrication of MOSFETs free from short channel side effects and drain punch through.

Claim 9 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsai et al. (U.S. Patent No. 5,648,287) and Chiao (U.S. Patent No. 4,503,601) in view of Yoo et al. (U.S. Patent No. 6,486,039).

The combined Tsai et al. and Chiao disclose the method as claimed and rejected above, including Tsai et al. disclose wherein the energy of the nitrogen ion implantation is at an energy between about 30 and 70, however, Tsai et al. do not disclose the units of the energy applied. Therefore, Tsai et al. do not disclose the method wherein energy of ion implantation is 10 to 50 keV. Yoo et al. discloses the method of implanting nitrogen at an energy of between 10 and 30 keV. It would have been obvious to one of ordinary skill in the art at the time the invention was made to perform the nitrogen ion implantation of Tsai et al. at the energy at which Yoo et al. disclose since the implant energy range at which Yoo et al. implants is sufficient to change the oxidation rate of the underlying material (see Yoo et al., column 5, lines 4-37).

Response to Arguments

Applicant's arguments filed July 6, 2004 have been fully considered but they are not persuasive. Applicants argue that neither Tsai not Yoo disclose the method of implant nitrogen into the gate electrode. The examiner notes that the amorphous silicon of Tsai et al. is subsequently doped, annealed and silicided, and thus is conductive, and acts as part of the gate electrode.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Frenkel et al. (U.S. Patent No. 6,365,516) is cited to show that a silicide portion of the gate is considered part of the gate electrode.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer M. Kennedy whose telephone number is (571) 272-1672. The examiner can normally be reached on Mon.-Fri. 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Niebling can be reached on (571) 272-1679. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

jmk

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